Collaboration and shared logic for creating value-added in three Finnish wooden multi-storey building projects

Toppinen, Anne

2019-09-03

Toppinen , A , Miilumäki , N , Vihemäki , H , Toivonen , R & Lähtinen , K 2019 , '
Collaboration and shared logic for creating value-added in three Finnish wooden multi-storey
building projects ' , Wood Material Science and Engineering , vol. 14 , no. 5 , pp. 269-279 . https://doi.org/10.1080/17

http://hdl.handle.net/10138/318328
https://doi.org/10.1080/17480272.2019.1653365

acceptedVersion

Collaboration and shared logic for creating value-added in three Finnish wooden multi-storey building projects

Anne Toppinen[ac*], Noora Miilumäki[ac], Heini Vihemäki[ac], Ritva Toivonen[ac] and Katja Lähtinen[b]

[a]*Department of Forest Sciences, University of Helsinki, P.O. Box 27, 00014, University of Helsinki, Finland,*presenting and corresponding author, anne.toppinen@helsinki.fi*

[b]*Natural Resources Institute Finland (LUKE), Latokartanonkaari 9, 00790 Helsinki, Finland*

[c]*Helsinki Institute of Sustainability Science (HELSUS), Finland*

Acknowledgement

We are grateful to the following funding bodies; Academy of Finland (ORBIT project, 307480) and Finnish Innovation Agency Tekes (Grant 642/31/2016). We wish to thank the informants that participated in the data collection, and M.Sc. Juho Pöyhönen for his excellent research assistance.

Collaboration and shared logic for creating value-added in three Finnish wooden multi-storey building projects

Increasing societal interest towards sustainable and low-carbon materials contributes to demand for wood-based materials and modern solutions for urban construction. Wooden multi-storey construction (WMC), however, is a relatively new phenomenon in the construction business, and collaborative business models in projects that adopt such novel building techniques are yet to develop. Shared logic is a key concept shaping the development of well-functioning business ecosystems, even though actor priorities may vary between the WMC business ecosystem members. This study examines applicability of business ecosystem concept based on actor perception involved in three Finnish WMC projects. The results suggest that elements from the business ecosystem thinking can be identified in all the cases. Moreover, network collaboration created benefits to the ecosystem, such as reference value and new insights from research and development. For some companies, engagement in the business ecosystem created financial and employment benefits, while some interviewees perceived these projects also to create immaterial value, such as awareness on sustainability issues in their business, marketing gains, or in the form of mutual learning effects.

Keywords: business ecosystem; wood-based materials; sustainability, value, collaboration

1. Introduction

Increasing societal interest toward more sustainable and low-carbon materials paves way for the use of wood in construction as a modern way of urban living, and as a part of bioeconomy and circular economy development (e.g. Toppinen et al. 2018, Lazarevic et al. 2019). According to Bourdeau (1999, p. 364), the main challenge of construction business is "to transform the demand for sustainable development into an opportunity, to create and access new markets, and innovative responses which satisfy traditional industry demands and the new societal demands for sustainable development." However, in comparison to product and process innovations, there are few sustainability related business model innovations in the wood products-sector (Hansen 2016) that could be used to speed up the growth of modern, low-carbon wood construction in the cities.

Modern timber building solutions include industrial wooden multi-storey construction (WMC), which is often characterized by high level of pre-fabrication (e.g. Brege et al. 2014) and hybrid building solutions combining wood with other materials, such as steel (e.g. Loss 2016). In spite of the fact that both of these types are increasingly associated with the green building concept (e.g. Wang et al. 2014), the WMC business has developed relatively slowly. For example in Finland, despite an intense promotional work and a significant change in building codes in 2011, and the increase in the market share of completed wooden multi-storey apartment buildings from 1% to 6% between years 2010–15, WMC still represents a marginal niche in total volume of residential construction.

According to Nordin et al. (2010), re-structuring and intensifying of business cooperation is needed to break free from a niche level of WMC. This would essentially comprise changing both internal (e.g. increasing collaboration with suppliers, on-site

contractors and engineered wood product manufacturers to develop off-site construction methods) and external factors (e.g. better implementation of R&D efforts with organizations and associations developing technical standards) affecting the WMC business. Pulkka et al. (2016) have shown the applicability of the business ecosystem concept in the construction industry setting, and that positive impacts on value creation can be achieved through collaboration, which extends beyond traditional collaboration such as project-based subcontracting (for traditional project-based organization of work see Toppinen et al. 2019). However, the business ecosystem concept, or its practical implications, have not yet been studied in the context of WMC business. According to previous research, there is also a research gap in eliciting project level insights on actor values, norms and belief systems as well as constitution of WMC as a business ecosystem (see Toppinen et al. 2019).

An important further aspect is the project-level nature of highly sub-contracted construction business, which calls for a good fit and coordination between interdependent and non-simultaneous tasks implemented within strict project timelines (Gann and Salter 2000). Matinaro and Liu (2017) stress stronger collaboration and more active communication as key elements of organizational innovativeness and improving sustainability in the field of construction, but they also point out that these aspects are not sufficiently emphasized in the current construction sector culture.

Strong path-dependency in the construction sector related to traditional building with concrete, and the lack of experience from collaborative networks in multi-actor construction projects, have been pointed out in several studies as the two main barriers for increasing the market share of WMC (Hemström et al. 2017, Gosselin et al. 2017, Toppinen et al. 2019). Mahapatra and Gustavsson (2008) argue that breaking the path-dependency of the current construction business requires investments in developing

education and skills, and building of new kinds of actor networks. Hence, analysing the interactions and perceptions of the business actors involved in WMC projects would bring better understanding on the potential and means of collaboration networks to create value also in these constellations abreast with adding comprehension on the roles of various actors in the business ecosystem.

The aim of this study is to fill this gap from WMC business and project level perspective by analysing the roles and experiences of actors involved in three residential urban WMC projects ongoing in Finland during 2017–19 based on the interview data. We aim to 1) study the applicability of theoretical business ecosystem concept, and particularly the role of shared logic, into real life cases. In addition, we seek to 2) examine potential for value creation and benefits for the involved business actors. Furthermore, we 3) analyse how sustainability related aspects emerge in the data; either within shared logic or from the accumulated benefits point of view.

2. Literature review

In their systematic literature review, Mokhlesian and Holmen (2012) analysed business models for the greening construction sector using the business model canvas by Osterwalder et al. (2005). Their results showed that the most important elements that facilitate change towards greener construction practices are capability, partner networks and value configuration. According to Hemström et al. (2017), Hurmekoski et al. (2018) and Toppinen et al. (2019), as one of the sources of inertia, there is strong path-dependency related to traditional building with concrete, and the lack of experience from collaborative network-based business models in multi-actor construction projects. Lazarevic et al. (2019) point out the problem of having dominance on pilot projects, where learning from previous experience is difficult.

These identified barriers also call for a change in the WMC business culture towards more open collaboration mind-set while building new business collaboration between different-sized and types of players. Network-based collaboration is among the means most commonly emphasized in business literature (e.g. Anderson et al. 1994) to tackle complex and risky projects like construction. Especially when getting involved in sustainable building initiatives and usage of new types of materials and processes, construction companies need to develop new capabilities and co-operation relationships, for example (Mokhlesian and Holmén 2012). Osterwalder et al. (2005) portrays the network of cooperative agreements with other companies necessary to efficiently offer and commercialize value. However, in comparison to institutional and sector level analysis, business and construction project-level perspectives including, for example, issues related to networking in the WMC building sector have not been much studied with Brege et al. (2014), Lessing and Brege (2015), Toppinen et al. (2018) and Miilumäki et al. (2019) being the few notable exceptions.

The rationale for the need of collaboration and the shared logic is that these are primary elements around a well-functioning business ecosystem, with probably a focal role over other ecosystem related aspects, such as network governance and network participant selection. According to a review by Aarikka-Stenroos and Ritala (2017), the business ecosystem concept emphasizes co-evolution, as well as increased interdependency and developing capabilities of participating actors. However, they also note that the term ecosystem is used in various ways, ranging from a synonym for business network to an analogy for interconnected environments.

In particular, as defined by Thomas and Autio (2014), the shared logic focuses on the cognitive elements, such as legitimacy of the business ecosystem, in which the trust and the mutual awareness of participants are the foundational elements. As shown

in illustration (Figure 1) adopted from Pulkka et al. (2016), the shared logic is a driver to the participation in the network, and thus indirectly influences value creation via, and it also has an effect on the governance system. According to Thomas and Autio (2014), the cognitive (or internal) legitimacy could be further described as “a shared understanding of what the emergent ecosystem is about and what it seeks to achieve” whereas external (or socio-political) legitimacy deals with acceptance of wider society and the business ecosystem functioning in accordance to its rules and legislation. Mutual awareness of the cooperating partners, their goals in cooperation, and the understanding of how the value is created and shared in the network are related key elements. Building trust requires time, and accumulation of experiences from working together. Thus, time is an essential element in building a well-functioning business ecosystem.

However, Bygballe and Ingemansson (2014) argue that construction companies tend to favour internal collaboration inside the company over the external collaboration with suppliers and customers in construction projects, and open innovation thinking is difficult to capture. Therefore, orchestrating a project-based value network that includes end-users is essential for firms to build their business models on customer needs, to be able to recognize customer value and create a business model that enables value capturing (Pynnönen et al. 2012).

Crespin-Mazet et al. (2015) have shown by using the concept of relational congruence that the history of relationships between actors in the temporary construction project setting influences the choice of partnering. Relational congruence is associated with the level of trust, commitment and commonality of goals and values between the actors involved in the project network, and predicts the engagement in long-term business relationships.

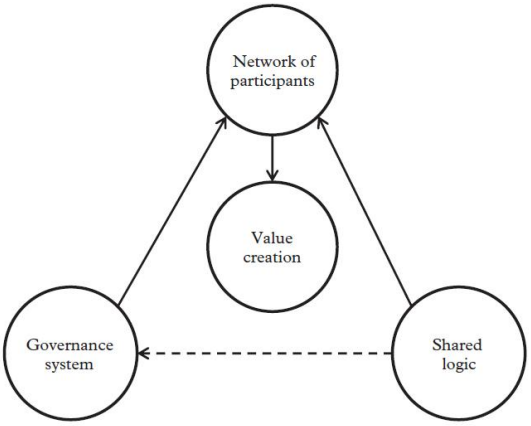

Figure 1. Business ecosystem characteristics affecting to value creation (adopted from Pulkka et al. 2016)

At practical level, functioning of a business ecosystem within a particular project is connected heavily with information sharing practices and mutual efforts of team building, despite temporal structures of a project. Meetings to gather disparate actors physically can be partially substituted via other means of communication or shared knowledge platforms and information systems. The shared logic can be also constructed by enhancing ecosystem identity that can be communicated by using shared logos and other symbols.

Essentially, actor priorities towards what constitutes a sustainable construction project, and how value is being created within businesses, may differ between the WMC business ecosystem members. For example, according to Toppinen et al. (2018), the perceived role of wood material by is only marginally related to wooden building being a long-standing carbon stock. Instead, addressing end-user health impacts in industrial construction business with the use of renewal materials can be a key instrumental channel for choosing wood rather than, for example, intrinsic motivation towards sustainability (Toppinen at al. 2018). Furthermore, according to Wagner and Hoegl

(2006), although involving suppliers in the early stages of new product development processes can be wise strategically, it may be difficult to capitalize on such strategic benefits at an individual project level.

Taken together, this leads us to the empirical exploration of our three main themes of inquiry. First, what kind of network structures can be identified among three case projects and how deeply shared are the project goals and visions, and second, how aligned are the network members views' on the benefits created and shared within construction projects. Third, from the perspective of customer value capturing, special attention is paid on whether material related sustainability aspects emerge among issues that bring added value in the WMC business networks.

3. Data and methods

Data from 23 semi-structured interviews were used to elicit perceptions and experiences of actors involved in three recent WMC building projects in eastern and southern Finland during 2017–19. The qualitative semi-structured interviews, which according to Brinkmann and Kvale (2015) encourage the interviewees to describe their experiences and actions in their own, enabling the interviewer to be open to new issues and phenomena. In addition, personal interviews increase interaction between the interviewer and the interviewee. These aspects were considered important in the case of WMC projects, where new topics will most likely arise, and because our aim was not to quantify meanings or elicit general opinions (Brinkmann and Kvale, 2015, p. 33–34).

The first project (Case 1) is a two-storey multi-family building with 14 apartments, the second one (Case 2) a three-storey building with 27 small-scale apartments and the third one (Case 3) is a 12-storey student housing project. During the time of the interviews regarding Cases 1 and 2, the building projects had been finalized.

Instead, Case 3 was during the interviews in the planning phase waiting for approval of the construction permit by the city administration.

The criteria for choosing the project cases were twofold: First, projects were expected to represent new types of WMC building projects in Finland, either in terms of their technological solutions or managerial aspects, or both. Second, the companies acting in key roles in project implementation had to be willing to collaborate with the research project. Regarding the first criterion, Cases 1 and 2 were chosen as rare examples of a novel type of WMC projects with private sector developer in charge, while Case 3 represented a pioneering higher rise housing project in its municipality.

In all of the case projects, wood was used as the construction material for bearing structures of the buildings (herewith "structural material"). Moreover, since WMC is still rather novel technological field, new technological solutions and methods, such as wooden floor slabs and module, were tested in all of the projects. However, the initial motivation for building with wood varied between cases: In Case 1 project the preference towards WMC was driven by main contractor company's own businesses and interests in wood element manufacturing, which resulted also in experimentation of a new kind of flooring element solution during the project. For the main developer company (i.e., company responsible for project organization and communication), Case 1 project was the first time experience in that role. Instead, the main developer had been testing new products in earlier construction projects from time to time due to its expertise on wood element manufacturing. As a result of this, within the company an interest in acting also as a main contractor had arisen. In comparison, in Cases 2 and 3, the choice of wood as a structural material was initiated by local municipalities through their land zoning decisions.

Table 1 describes the interviewees in each of the three cases. It should be noted that when Case 1 was investigated in 2017, it was seen necessary to cover a wider variety of actors in the interview data than in Case 2 and Case 3. Thus, Case 1 included also material gathering from various subcontractors in the building project, in order to gain a more profound understanding on the structure of a WMC ecosystem. After this, the material from interviews conducted in the end of 2018 and beginning of 2019 regarding Case 2 and Case 3 projects was possible to be analysed by using a bit more simplified setting by focusing on the key players in the core business ecosystem using snowball sampling. Therefore, municipality representatives or real estate agents, for example, were not relevant bodies to be interviewed in these latter cases.

In Case 1, the researchers contacted the possible interviewees based on project document provided by the main developer company. All companies listed in the document participated in the interviews. In Case 2, a contact person working in one of the companies contributing to the construction project provided a list of the main project actors (i.e., companies) who could be contacted and again all companies listed participated in the interviews. In Case 3, the contact information for the companies already chosen for the project implementation was obtained from the project consultant at the planning phase of the project.

The interviews were conducted by two researchers, one conducting the Case 1 interviews, and the other researcher the Case 2 and 3 interviews, but familiarizing oneself also with the Case 1 data. Furthermore, the semi-structured interview guide was identical in all interviews to ensure that the same main topics would be discussed during the interviews. Interviews were conducted face-to-face, whenever possible. However, due to tight schedules of the actors, some interviews were conducted via phone. In addition, one interviewee in Case 3 was only able and/or willing to respond via email.

Table 1. Overview of interviews.

Type of member in BE	Number of interviews	Additional information on professional background	Interview method, duration
CASE 1			
Developer/ main contractor	3	Director of planning, R&D and IT Element designer Main site supervisor	Phone, 75 min Phone, 43 min Face-to-face, 52 min
Project actors	9	Architect Structural engineer (structures) Structural engineer (foundations) Heating, piping and air conditioning engineer Excavation and yard work Foundation work Heating, piping, air conditioning and electricity site supervisor (x2) Real-estate agent Door and window supplier	Phone, 56 min Phone, 36 min Phone, 58 min Phone, 78 min Phone, 86 min Phone, 102 min Face-to-face, 52 min Face-to-face, 78 min Phone, 32 min
Municipality representative	1	Zoning architect	Face-to-face, 63 min
CASE 2			
Developer/ main contractor	3	CEO Architect/main designer Main site supervisor	Face-to-face, 101 min Face-to-face, 144 min Face-to-face, 55 min
Project actors	2	Planning and R&D manager of wood element supplier Structural engineer	Face-to-face, 41 min Phone, 27 min
CASE 3			
Developer	1	Construction manager	Face-to-face, 41 min
Project actors	4	Project manager (consultant) Architect Heating, piping and air conditioning engineer Electrical engineer	Face-to-face, 84 min Face-to-face, 100 min Face-to-face, 27 min Email

All interviews were recorded and transcribed. The data were analysed by listening to the recordings and reading the transcriptions and seeking for recurring themes, which enabled answering the studied research questions. The main occurring themes, in line with business ecosystem thinking, were the following; collaboration and co-operation, aim(s) of the project, perceived benefits of the project, opportunities for co-learning and new ways of working, and co-evolution. Most of the topics and themes discussed during the interviews were recurring, which indicates that taken together the data saturated quite well. The results obtained do not aim to be generalizable, but to increase understanding on shared logic in the context of WMC projects (and business).

4. Results

4.1 Building the foundation of a business ecosystem: trust and mutual awareness among network partners

Figures 2–4 are simplified illustrations of business ecosystems in Cases 1–3. According to our analysis, each business ecosystem had an actor (one company) representing a hub of the network. In the Figures, darker ovals represent actors with several previous/ongoing activities within the hub, while lighter ovals represent more occasional partners. The results show, that the main developer (company) communicated with all actors within the business ecosystem (dark lines). In addition, direct communication also occurred between some of the other actors (lighter lines, which indicates communication expressed during the interviews).

In Cases 1 and 2, the hub was the main developer/constructor, whereas in Case 3 the hub was formed by the customer and the consultant hired by the customer to act as the project manager. The hubs all possessed experience on wood construction, although in Case 3 the customer mostly relied on the expertise of the hired consultant with prior experience of building with wood. In all the three cases, the hub governed the project and communicated with all actors. Additionally, nearly all of the actors in the enlarged business ecosystem were interacting with one another also directly. In all cases, future residents were visible in the outer layer of the business ecosystem. They were not active members of the business ecosystems. For example, they did not participate in customer value creation processes, which is common for building projects (Vischer, 2008).

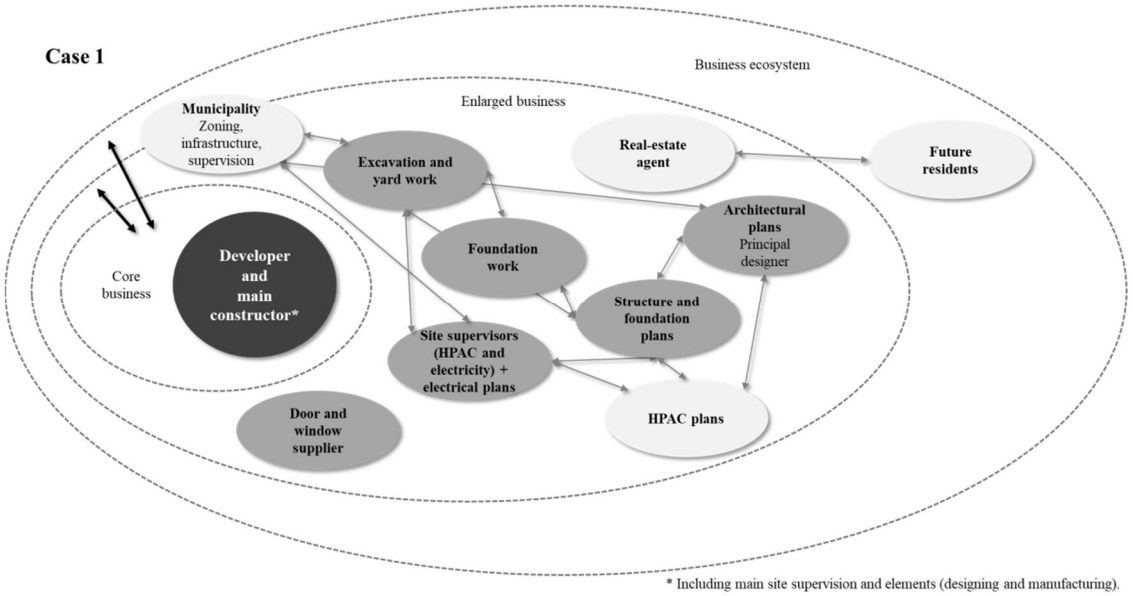

Figure 2. Map of the business network in Case 1.

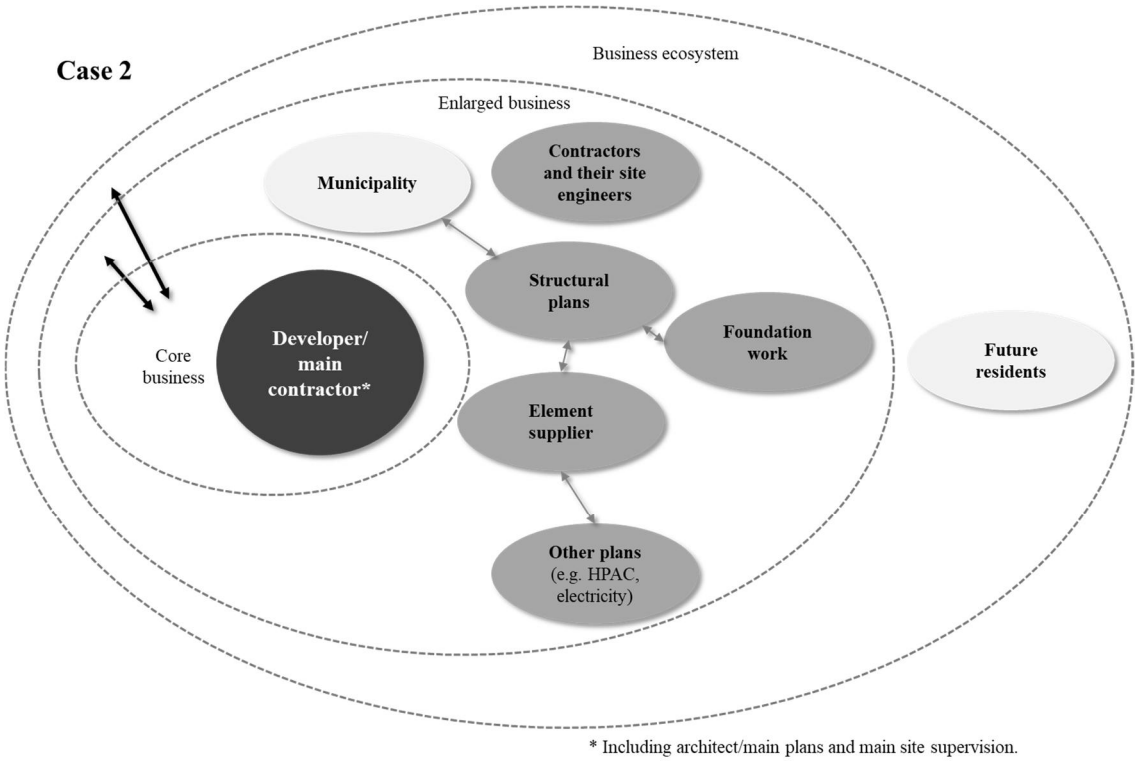

Figure 3. Map of the business network in Case 2.

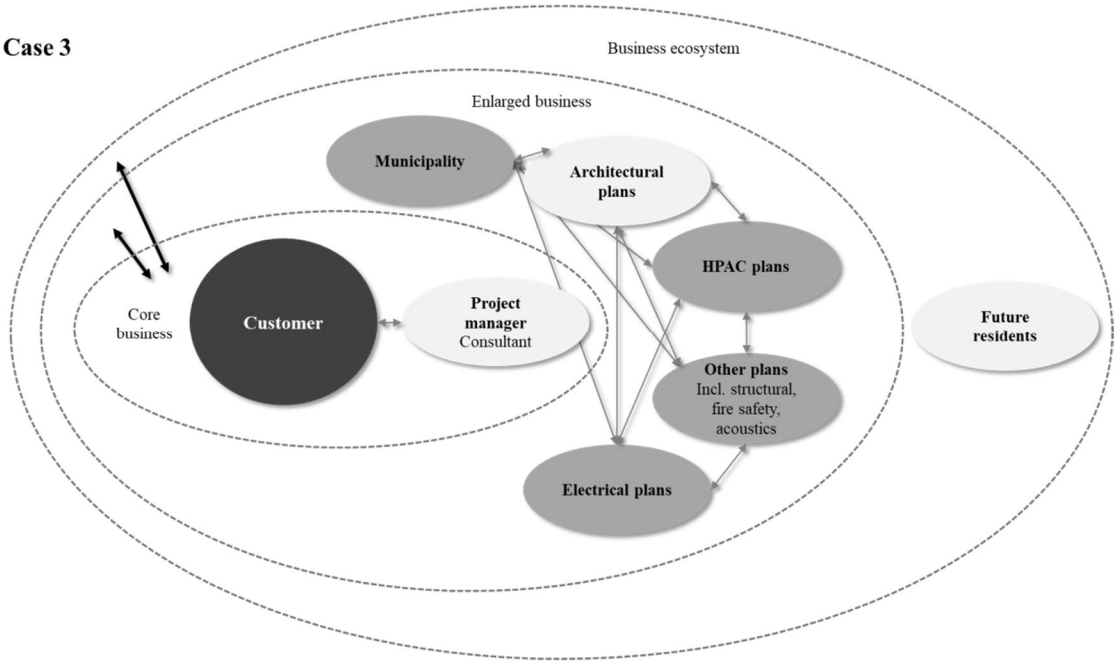

Figure 4. Map of the business network in Case 3.

Efficient communication and information sharing is emphasized to be an important aspect for a project network to enable smooth functioning and to create a complete complex product, i.e. such as a building (see, e.g., Bosch-Sijtsema and Henriksson, 2014), as was also described by one of the designers of Case 3:

> The architect needs some information from us to get forward and we need some information from the architect. We need structural designers, electrical engineers need us, we need electrical engineers, so it is that kind of information transfer in order for everyone to be able to move forward in their own work. - *Heating, piping and air conditioning engineer, Case 3*

The interviewees further emphasized that communication and co-operation had become easier when the project actors had started to know each another better. In general, communication with familiar partners makes the interaction more informal, creates a pleasant working environment and speeds up work when the actors have previous experience on how their partners prefer to work and communicate. Familiarity and trust

in discontinuous inter-organizational settings, such as building projects, has been demonstrated playing an important role when collaborating and sharing knowledge (Maurer 2010).

Familiarity was also described by the interviewees to breed trust between the actors, which helps to ensure that each actor did their designated duties as stated in the contract without additional supervision. However, some interviewees did further point out that a degree of flexibility should also be nurtured: all actors should be willing to help other actors beyond their contracted boundaries, and think about the "greater good" of the business ecosystem.

Because of the benefits of working with familiar partners, all three hubs had recruited the actors to the project network mainly from the group of actors they already had experience in working with (see Figures 2–4). This was favoured over the alternative of using open invitations for tenders, which is common in the construction business. In the latter, the result tend to favour mainly actors providing low cost and speed (Blayse and Manley, 2004). The architect/main designer of the Case 2 explained this as follows:

> We have of course aimed towards long-term collaboration in designing and [choosing] contractors, so that projects would be such that all [designers and contractors] can manage … we refine the collaboration all the time when we move forwards … You quite often see that that the aim is to find the cheapest price and then the partners change every time, especially when business conditions are good … Building these wooden multi-storey constructions is a bit of a special field, so if you have trust you should [hold on to good partners]. - *Architect/main designer, Case 2*

The architect, as well as other actors, also perceived that the co-evolution with the business ecosystem actors is important in deepening co-operation. This is crucial especially in the case of multistorey timber buildings, which are still at niche among the

construction firms, and hence requires additional considerations from the business ecosystem. The existing teamwork amplified with trust and an open, amiable working environment, had already spawned future projects between most of the actors in Case 1. As described, for example, by the site manager of Case 2, each future WMC project with the same actors will help to gain knowledge and reduce the number of encountered problems, getting closer to upscaling production of WMC, project by project. However, the interviewees also reminded that their other ongoing projects and lack of time might hamper co-operation and co-evolvement, as time and efforts have to be allocated between several projects.

Finally, it seems that the actor networks in Cases 1–3 mainly consisted of the project hub, designers and other contractors, while the roles of the other actors such as municipality and future residents, was to remain at the outer border of the business ecosystem. Valuing internal networks higher than external ones is, however, common in construction projects, and has been suggested to hamper learning and innovation processes (Bygballe and Ingemansson, 2014). Yet, the municipality was considered as an important gatekeeper, especially in Cases 2 and 3. In these cases, the municipality had granted the plot based on a competition and required wood to be utilized as a structural material for buildings to be constructed in these plots. According to the results, the novelty of the projects and the construction material had set requests for further communication between the projects and the municipalities, as described below by one of the managers:

> [The communication with the municipality] went smoothly, even though we had to present alternative solutions a couple times before the permit was granted, but still. … supposedly it is the same situation all over Finland, because building inspectors do not have that kind of experience from wooden construction. And standards and

> all this sort of stuff are not maybe so refined as they are in concrete building. - *Construction manager, Case 3*

In Case 3, the height of the planned building exceeded the maximum number of floors that the Finnish building regulations (fire code) allow for WMC buildings without special permits Due to that, receiving the building permit had required more intensive communication than usually with the municipality. Additionally, an interviewee in Case 2 underlined that for them it had been highly important that "the city has not complicated [the project] in any way" (Architect/main designer, Case 2). Hence, the municipalities may have had a greater role in the business ecosystems and creating legitimacy than to what the initial descriptions of the actors give credit for (see Franzini et al. 2018).

The studied case projects possessed some characteristics of 'traditional' construction projects, with a need for deepening co-operation and increasing communication between different designers in order to enhance business operations (e.g., Lessing and Brege 2015). Yet, the interviews revealed that deeper-than-usual collaboration, trust and co-evolution had already evolved due to the novelty of the WMC methods and products. Furthermore, this seemed to have also increased the communication with the municipalities, which were likewise still learning about WMCs, bringing different actors closer to the centre of the business ecosystems. The main actors in the ecosystems had close communication and interaction with the hub and with each other (see Figures 1–3). In contrast, evidence on recognizing the potential importance of the end-users, for example, for developing WMC business was rather limited in the interview data. Thus, expanding the awareness and collaboration also to these outer layers of the business ecosystem could further help in increasing knowledge about WMC and comprehension on its value capturing possibilities.

4.2 Sharing of goals and visions

The interviewees showed some consistency in their views that shared goals in the building projects had included aiming at high quality and testing new products. This is illustrated by a quote from Case 1:

> ”Well, the aim is to build high-quality homes to people, with as low costs as possible.” - Site supervisor, Case 1

Meeting financial targets of the construction project was considered elementary, but also other goals were identified, exemplified by a quote by the CEO of the developer in case 2:

> Of course, we have always this… target profit which we need to reach in those projects. … And if we think about that project in particular, it is always a good thing to win such an architect competition, and the land use plan provided an opportunity to build something we believed to be well suited for the area and the time-frame. We saw participating [in the competition] to be good. We knew that [the element supplier] had the capacity to supply such as project to us. And we also found the schedule to be suitable for us. - *Developer’s CEO, Case 2*

Furthermore, there were specific brand-building goals also associated with the WMC projects, as the following example from Case 3 shows:

> I got the impression that this was understood [by the developer] as one hell of a branding project. … if you want to do something new and renew yourself, no matter what kind of organisation, sometimes you need to something stupid, compared to previous dogmas. … Part of the goal has definitely been to show that this is possible. - *Architect, Case 3*

While the actors shared an understanding of the project’s benefits at some level, most were still not aware of the larger goals envisioned by the hub company. As described by

the representatives of the three different hubs, the overarching goals had been to test new products (Case 1), learn from WMC in general (Case 2), and to create a durable, easy to maintain and healthy building (Case 3). For example, one interviewee explained his understanding of the developer's goal as follows:

> Well I do not know, of course the contractor has their own clear goals for the whole project, to build a successful and financially profitable project, of course these [reasons] are surely there. I do not know all of the [goals] precisely; one would need to ask the contractor how they see them. - *Representative of wood element supplier, Case 2*

While his description is quite similar to the actual goal of the developer, it is also rather general also revealing that the goal was not fully shared among the business ecosystem actors. An interviewee in Case 3, on the other hand, recalled the goal of their project:

> "How was it? It was in the first design meeting. Cost-effective, cosy student apartment. Could it have been something like that?" - *Heating, piping and air conditioning engineer*, Case 3).

Other interviewees further indicated that the hub firms do usually disseminate the overarching goal in a kick off-meeting in which most the actors are present. It seems, however, that in some projects such meetings had been perhaps missing or the goal otherwise had been communicated in an unclear manner. Further, the coherence of the project network had probably been affected by the geographic distance between the actors and between the actual construction site. The architect of Case 3 described this as follows:

> This was kind of a mishmash instead of maintaining an overall target schedule. … especially when the rest of the design team is from [the rural] regions, or not from [the capital area] and we are the only designer [in this project] working from the capital. - *Architect, Case 3*

Thus, the geographic distance seems to require additional efforts in communication practices. Some interviewees from Case 2 described using Skype for meetings when actors cannot be physically present, which had worked out in their case. However, the above quote – as well as contents of other interviews – indicates that solid leadership plays a key role in ensuring efficient co-operation and creating a feel of togetherness, including the dissemination of the shared goal. Especially in Case 1 with an unexperienced main contractor this became visible, for example in the form of deficiencies in project management, like described by the actor responsible for the building foundations:

> Yes [we were in a too much hurry]. And it is probably partly because there was no proper project management. It was kind of the excavation company, and everyone, working on their own. There was no proper project management, which would have dealt with the schedules and made sure that everything fits between the different actors. - *Foundation work, Case 1*

This interviewee further continued that he felt this project to be less of a mutual effort compared to some other projects he had worked in, which demonstrates the importance of leadership skills and experience. It was also brought up by some of the interviewees that the lack of communication is somewhat common in all construction projects, at least when considering receiving feedback from the site to the desks of the designers. Yet, especially in case of learning and accumulating knowledge of new type of building projects, communication is of a great importance (Gann and Salter, 2000; Mokhlesian and Holmén, 2012).

In the end, however, all the interviewed actors seemed to share a fairly similar logic – building homes of good quality and value – independent whether they had been aware of a shared overarching goal or not. Each actor also had had their own specific goals and frames, partly related to their task or role in the business ecosystem, such as

ensuring proper airflow to the apartments, or designing apartments of a certain size and functionality. All the interviewees recognized that their individual skills and goals, when combined, created the functioning network:

> Sure, this here is team work… Meaning that everyone works together for a common goal. It does not really work out, if everyone just plods alone with their own tasks and then… Some conflicts will emerge, and you have to play together to succeed. *Structural engineer 2, Case 1*

This issue became even more clearly evident, in the context of discussions on developing the novel WMC methods and products. Related to that, the interviewees stated that the need to develop shared vision for the future is characterized by continuum in co-operation among companies to refine and deepen their knowledge on WMC. For example, consultant in Case 3 and the main site supervisor in Case 2 stated following:

> We won't be able to [develop wooden construction] in any other way than having this kind of repetition and getting that know-how for it and development and enough volume… - *Consultant, Case 3*

> In my opinion this has been learning for everyone still. … Always new things. So now that we would build such a building next time with the same crew, it would be quite a lot clearer. - *Main site supervisor, Case 2*

As a promising sign of deepening WMC business ecosystem, some of the actors had committed to continue their collaboration on WMC for the years to come. This was based on not only skills, but also mutual trust. The results also indicated that project leadership and common meetings are in a key role when sharing the vision and ideology of the project to the ecosystem members. These are emphasized even further when the physical distance between the members is long and/or the construction site is not

located in proximity, generating a need to be creative in communication methods. With these aspects in order, the business ecosystem members were more likely to be aware of the overarching vision set by the hub. However, even without a clearly communicated common goal, all the actors were aiming towards similar targets – high quality and cost efficiency – both in their own work, but also when thinking about the final product. Wood as a construction material had created also a push for future collaboration between the ecosystem members, in which gaining knowledge, experience and familiarity with the characteristics of wood in multistory buildings projects was seen to play a role (see also Lazarevic et al. 2019 on the pilot nature of the projects). Finally, the acceptance of wider society and operating in accordance to legislation - was more difficult to examine based on the internal business ecosystem data, and is left for future research.

4.3 Accumulation of project benefits and emergence of sustainability aspects

Visibility/credibility and experience in innovative materials/technologies

As described, all three cases included novel approaches, e.g. in the form of new construction techniques or new roles of the organizations involved. When asked about the benefits of the project, and what co-operation would bring to the company itself as well as to the other companies, several interviewees mentioned gaining experience from WMC and benefits from research and development, as well as visibility created specifically by the novelty of WMC and the techniques applied:

> This was our first [wooden multi-storey construction], so [the project] provided us a great deal of experience. - *Structural engineer, Case 2*

> I would think building specifically a completely new kind of wooden multi-storey construction has been the benefit for all [participating in the project], above all it

> provides visibility and interest. And maybe some sort of boldness from the organisation to do new things. That is the biggest [benefit]. - *Architect, Case 3*

The boldness to challenge existing routines as well as adaptability inside the otherwise quite rigid construction business environment was considered to be important in generating the above-mentioned benefits. The interviewees reminded that these benefits cannot be generated without proper communication and co-operation. For example, the learning process was described to require feedback loops and constant interaction both during the design and construction phases (Gann and Salter, 2000; Mokhlesian and Holmén, 2012). Additionally, working with a well-known, large partner company was seen to increase the credibility and visibility of newly established and smaller companies. Financial gains and future business opportunities were also commonly mentioned as benefits, although some interviewees did point out that the profit margins of such experimental projects cannot provide the company any major gains other than accrued experience. Learning to work with wood in multi-storey applications was seen as a shared benefit among the ecosystem members, who were working directly with the material, either on their design tables or at the site.

Sustainability in construction business

Improved sustainability as a shared benefit, or vision, was not heavily discussed among the interviewees in a spontaneous manner. The issue was mainly prompted by direct questions related to what the interviewees thought about, for example, the ecological aspects of WMC. In Cases 2 and 3, the hubs of the ecosystem brought up issues such as lowered CO_2-emissions of wood compared to concrete as a benefit to the end-users, or possibility of providing renewable energy and/or district heating for the

buildings. Furthermore, the life cycle of the building, was only briefly mentioned, as described below by the CEO of Case 2.

> "if you would know how to maintain the building throughout its whole life cycle regardless of what it has been made of, it would result in a lower carbon footprint. It doesn't make any sense to construct a building of whatever material and then demolish it after thirty, forty years" - *CEO, Case 2*

In Case 1, the representative of the municipality voiced how WMC as a platform for residential building solutions can generate a benefit through indicating the municipality's positive attitude towards the environment and ecological aspects. Similar type of ideas have been emphasized also in other studies in the Finnish context (e.g., Franzini et al. 2018).

5. Discussion

Using interview data from ongoing/recent WMC projects from Finland, the purpose of our study was to evaluate the applicability of the theoretical business ecosystem concept, and assess the potential of the related cooperation-based benefits and the degree of business ecosystem thinking for value creation in the WMC business. Furthermore, we evaluated how sustainability related aspects spontaneously emerged in the three WMC projects studied.

The results indicate that the realized models of co-operation between the different actors during the construction project, and the accumulated experience from the construction project, both create various benefits for the partnering companies. The identified benefits included reference value and new insights from research and development, which were seen useful for the future business success. Interestingly, for some managers, engagement in these projects was perceived to create more narrowly only financial and employment benefits for their companies. Instead, for others, these

projects also created immaterial value, such as increased sustainability awareness, marketing or brand development gains, or mutual learning effects.

It seems evident based on the analysis of all the three projects that strong sustainability driven culture for this traditional field of construction business, or strive for creating business models that could capture sustainability-based value, is still weak. Despite dealing with low-carbon and sustainable material like wood, it seems clear that further research is needed on the analysing trust and mutual awareness of business actors within wood construction sector from the sustainability perspective. While in the current case-project setting it was thus not possible to dwell deeper into underlying mental barriers that stop seeing the project in a larger scope in relation to ongoing discussions on how to mitigate climate impacts, for example.

Interestingly, among the three cases analysed in this study, there was no indication of a partnership model, in which construction participants would work together as an integrated collaborative team, or that the team has a joint management structure under multi-party contractual arrangements of project partnering or an integrated delivery system. These aspects have gained growing interest, also in the Finnish utility construction market (Lahdenperä 2012).

In the future research, there is a need for deepening the understanding of the sustainability issues affecting the acceptability of wood among different types of consumers, as also voiced by Lähtinen et al. (2019a). The role of the public sector, including municipalities responsible for city planning and zoning, can also be decisive in constructing a test-bed (via norms, regulations and innovation policy tools) for new business networks and ecosystem-based trials (see also Franzini et al. 2018, Lähtinen et al. 2019b). Consequently, analysing aspects from external (so called socio-political legitimacy) view, and investigating which external drivers for sustainability originates

from, would be interesting (see also Hurmekoski et al. 2018, Toppinen et al. 2019). Focusing on co-evolutionary aspects of the project partners with the use of longitudinal data would be most interesting element also for deepening business ecosystem research in the future.

6. **Conclusions**

This paper explored the applicability of theoretical business ecosystem concepts in the context of real life WMC projects; examined the potential of the business ecosystems for value creation and benefits for the involved business actors; and analysed how sustainability related aspects emerge in the data; either within shared logic or from the perceived benefits point of view. According to our results, it was possible to identify the business ecosystem with shared logic concept in all the three case WMC projects, though the depth and duration of collaboration network varied. Sustainability aspects of these WMC case projects seemed to stay mainly hidden under the day-to-day business and construction practices. Learning to work with wood in the multi-storey applications is likely the greatest outcome of emerging business ecosystems in addition to building familiarity with the new partner networks.

References

Aarikka-Stenroos, L. and Ritala, P. (2017). Network management in the era of ecosystems: Systematic review and management framework. *Industrial Marketing Management*, 67, 23-36.

Anderson, J., Håkansson, H. and Johanson, J. (1994). Dyadic Business Relationships Within a Business Network Context. *Journal of Marketing*, 58(4), 1-15.

Blayse, A. M. and Manley, K. (2004). Key influences on construction innovation. *Construction Innovation*, 4(3), 143–154.

Bosch-Sijtsema, P. and Henriksson, L. (2014). Managing projects with distributed and embedded knowledge through interactions. *International Journal of Project Management*, 32, 1432-1444.

Bourdeau, L. (1999). Sustainable development and the future of construction: a comparison of visions from various countries. *Building Research & Information,* 27(6), 354-366.

Brege, S., Stehn, L., and Nord, T. (2014). Business models in industrialized building of multi-storey houses. *Construction Management and Economics,* 32, 208–226.

Bygballe, L. E. & Ingemansson, M. (2014). The logic of innovation in construction. *Industrial Marketing Management*, 43(3), 512–524.

Crespin-Mazet, F. Ingemansson Havenvid, M. and Linne, Å. (2015). Antecedents of project partnering in the construction industry —The impact of relationship history. *Industrial Marketing Management*, 50, 4–15.

Franzini, F., Toivonen, R. and Toppinen, A. (2018). Why not wood? Benefits and barriers of wood as a multi-storey construction material: perceptions of municipal civil servants from Finland. *Buildings*, 8(11), 159.

Gann, D. M. and Salter, A. J. (2000). Innovation in project-based, service-enhanced firms: the construction of complex products and systems. *Research Policy*, 29(7–8), 955–972.

Gosselin, A., Blanchet, P., Lehoux, N. and Cimon, Y. (2017). Main motivations and barriers for using wood in multi-story and non-residential construction projects. *BioResouces*, 12(1), 546-570.

Hansen, E. (2016). Responding to the bioeconomy: Business model innovation in the forest sector. In Kutnar, A., and Muthu, S.S. (eds): Environmental Impacts of Traditional and Innovative Forest-Based Bioproducts. Springer, Singapore. pp. 227–248.

Hemström, K., Gustavsson, L. and Mahapatra, K. (2017). The sociotechnical regime and Swedish contractor perceptions of structural frames. *Construction Management and Economics*, 35(4), 184–195.

Hurmekoski, E., Jonsson, R. and Nord, T. (2015). Context, drivers, and future potential for wood-frame multi-story construction in Europe. *Technological Forecasting and Social Change*, 99, 181–196.

Hurmekoski, E., Pykäläinen, J. and Hetemäki, L. (2018). Long-term targets for green building: Explorative Delphi backcasting study on wood-frame multi-story construction in Finland. *Journal of Cleaner Production*, 72, 3644-3654.

Lahdenperä, P. (2012). Making sense of the multi-party contractual arrangements of project partnering, project alliancing and integrated project delivery. *Construction Management and Economics*, 30(1), 57–79.

Lazarevic, D., Kautto, P. and Antikainen, R. (2019). Finland's wood-frame multi-storey construction innovation system: Analysing motors of creative destruction. In press, *Forest Policy and Economics*.

Lessing, J. and Brege, S. (2015). Business models for product-oriented house-building companies – experience from two Swedish case studies. *Construction Innovation*, 15(4), 449-472.

Lähtinen, K., Harju, C. and Toppinen, A. (2019a). Consumers' perceptions on the properties of wood affecting their willingness to live in and prejudices against

houses made of timber. *Wood Material Science and Engineering*, available in online version.

Lähtinen, K., Malm, N. and Toppinen, N. (2019b). Lobbying Urban Planners' Views on Wood Material in Multi-Storey Building Sector in Finland. *Bioproducts Business*, 4(7), 77–92.

Loss, C., Piazza, M., and Zandonini, R. (2016). Connections for steel–timber hybrid prefabricated buildings. Part I: Experimental tests. *Construction and Building Materials*, 122, 781-795.

Mahapatra, K. and Gustavsson, L. (2008). Multi-storey timber buildings: breaking industry path dependency. *Building Research & Innovations*, 36(6), 638–648.

Maurer, I. (2010). How to Build Trust in Inter-Organizational Projects: The Impact of Project Staffing and Project Rewards on the Formation of Trust, Knowledge Acquisition and Product Innovation. International Journal of Project Management, 28(7), 629-637.

Miilumäki, N., Kylkilahti, E., Autio, M. Pöyhönen, J. and Toppinen, A. (2019). With a collaborative effort towards sustainability – A business ecosystem approach to a wooden multi-storey construction project. Manuscript in review.

Mokhlesian, S. and Holmen, M. (2012). Business model changes and green construction processes. *Construction Management and Economics*, 30, 761-775.

Nordin, F., Öberg, C., Kollberg, B. and Nord, T. (2010). Building a new supply chain position: an exploratory study of companies in the timber housing industry. *Construction Management and Economics*, 28(10), 1071–1083.

Osterwalder, A., Pigner, Y. and Tucci, C. (2005). Clarifying Business Models: Origins, Present, and Future of the Concept. *Communications of the Association for Information Systems*, 16:1

Pulkka, L., Ristimäki, M., Rajakallio, K. and Junnila, S. (2016). Applicability and benefits of the ecosystem concept in the construction industry. *Construction Management and Economics*, 34(2), 129–144.

Pynnönen, M., Hallikas, J. and Ritala, P. (2012). Managing customer-driven business model innovation. *International Journal of Innovation Management*, 16(4), 1250022.

Toppinen, A., Autio, M., Sauru, M. and Berghäll, S. (2018). Sustainability driven new business models in wood construction towards 2030. In: (eds. Filho, W., de Lima, I., Pociovalisteanu, D. and Brito, P.) *Towards a sustainable bioeconomy: Principles, Challenges and Perspectives*. World Sustainability Series, Springer. pp. 499-516.

Toppinen, A., Sauru, M., Pätäri, S., Lähtinen, K. and Tuppura, A. (2019). Internal and external factors of competitiveness shaping the future of wooden multi-storey construction. *Construction Management and Economics*, 37(4), 201-216.

Thomas, L.D.W and Autio, E. (2014). The fifth facet: The ecosystem as an organizational field, DRUID Society Conference, Copenhagen, Denmark. 16-18 June 2014. http://conference.druid.dk/acc_papers/qpja8vqx0vto0qkn5vg3uiqafb24.pdf

Wagner, S. and Hoegl, M. (2006). Involving suppliers in product development: Insights from R & D directors and project managers. *Industrial Marketing Management*, 35(8), 936-943.

Wang, L., Toppinen, A., and Juslin, H. (2014). Use of wood in green building: A study of expert perspectives from the UK. *Journal of Cleaner Production*, 65,350–361.